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EXAMINER	
NEWMAN, MICHAEL A	

ART UNIT	PAPER NUMBER
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/754,013	LEE ET AL.	
	Examiner	Art Unit	
	MICHAEL A. NEWMAN	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 February 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendment received on February 4th, 2008, has been entered. No changes to the claims or the rest of the disclosure have been made.

Response to Arguments

2. Applicant's arguments filed on February 4th, 2008 have been fully considered but they are not persuasive.

a. In pages 8 and 9 of the Remarks filed on February 4th, 2008, with regards to the rejection of the independent claims 15 and 23, under 35 U.S.C. 102(e) over Noguchi et al. (U.S. Patent No. 7,037,735), "Noguchi"; Applicant's Representative submits that Noguchi fails to teach several limitations of claim 15.

Initially, Applicant's Representative submits that the threshold value in Noguchi is not preset, as required by claim 15, but rather is calculated based on the signal level of the entire wafer. The Examiner respectfully disagrees. One of the basic concepts of Noguchi is to take into account the magnitude of the signal variations in the determination of a threshold to improve defect detection. From this, it appears that the threshold is not "preset", for example, by a user or the like. However, Noguchi computes, *in advance*, a threshold value for each chip in a wafer from data acquired in advance. Specifically, as discussed in Col. 41 lines 28 – 43, "[t]hreshold values are computed in advance for the same processes of LSIs of the same type… [and] are typically stored in a threshold-value

memory…" Therefore, even though the threshold values are calculated, they are calculated prior to the comparison. Lacking any explicit definition in the claims of how the threshold is preset, the Examiner believes the above interpretation is reasonable.

Secondly, Applicant's Representative submits that Noguchi does not complete the two step process of forming a second differential data and then forming a third differential data from the second data, as required by claims 15 and 23. The Examiner respectfully disagrees. Applicant's Representative correctly points out that Noguchi uses different size 'filters' or operators to improve the detection of defects having specific detected pixel sizes, the outputs of the operators are then summed to generate an enhanced defect image. Applicant's Representative further submits that Noguchi, therefore, does not further limit the pixels being looked at as defective. Regarding this limitation, the claims recite: "forming a third differential image data of the target pixel when the second differential image data of the target pixel is within the reference size range of the specific defect." The first differential image data is obtained by extracting the difference in image signals between corresponding neighboring chips. This differential image data is then compared to the threshold discussed above to obtain the second differential image data, and displayed as a threshold-value map image. The user can then specify conditions such as particle size sensitivity by selecting the range of particle sizes to detect. The result on the threshold-value map images due to different selections can be seen in Fig. 45, see Col. 46

lines 51 – 67. The user can check the sensitivity, or particle size criterion, based on the displayed image and modify if necessary (Col. 48 lines 10 – 13). The examiner respectfully submits that the different threshold-value maps shown in at least Fig. 45 are third differential image data obtained from the second image data based on the desired particle size sensitivity criteria indicated by the user. Clearly, the displayed defects are limited based on the different size choice.

b. In pages 9 and 10 of the Remarks, with regards to the rejection of the independent claims 1 and 29, under 35 U.S.C. 103, over Noguchi et al. (U.S. Patent No. 7,037,735), “Noguchi”, in view of Hung et al. (U.S. Patent No. 7,162,071), “Hung”, Applicant’s Representative submits that the combination appears improper for the following reasons.

First, Applicant's Representative submits that the combination of Hung appears incompatible because Hung states that "the present classification method eliminates the need for light calibration and for pixel conversion." Although the Examiner agrees that Hung's invention does present that advantage, the Examiner fails to see how this renders the combination improper. Hung eliminates the need for light calibration and pixel conversion because the reference defect images are 'progressively learned' in the same testing environment, such that the reference images are acquired under the same lighting conditions and with the same detector as the masks being tested; therefore, both exhibit same lighting characteristics and having the same pixel-to-measurement unit scaling. This is similar to Noguchi in that Noguchi also obtains

prior reference data from similar chips. Thus, the Examiner insists one would not be discouraged from combining both inventions by Hung's statement.

Applicant's Representative further submits that Noguchi's setting of threshold values based on a standard deviation calculation results in a very different analysis method than that detailed in the Hung reference, and thus it would not have been obvious to make a simple substitution of the Hung threshold setting feature with that of Noguchi. In the 103 rejection of claims 1 and 29 of the previous office action, it was reasoned that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Noguchi's pixel-to-pixel comparison with a collection of known defect images, as taught by Hung, in order to *not only detect defects, but also speedily classify them*..." The combination was not envisioned as a substitution of Noguchi's threshold scheme, but instead as a further classification step in which the result of Noguchi's difference image step, which finds the difference between each pixel of the current chip and each corresponding pixel of a neighboring chip to detect defects is used as the input target defect image to Hung's defect *classification* scheme. In Col. 3 lines 7 – 16, Hung discusses the possibility of using any image massaging method to obtain a defect image map. One of ordinary skill in the art would have recognized that Noguchi's threshold-value map image showing the detected defects could be used as Hung's defect image map.

c. Given this reasonable interpretation of the claims and the prior art, the Examiner *respectfully* insists that the standing rejections, as clarified, are proper.

Double Patenting

3. A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

Claims 15 - 28 are provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1 – 27 of copending Application No. 10/749,670. This is a provisional double patenting rejection since the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 102

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 15 – 19, 21 – 26 and 28 are rejected under 35 U.S.C. 102(e) as being anticipated by Noguchi et al. (U.S. Patent No. 7,037,735).

a. Regarding claims 15 and 23, Noguchi teaches a method and apparatus for detecting a defect on a substrate, the apparatus comprising: a support for supporting a substrate **(Noguchi Fig. 3 element 304)**, wherein the substrate has a plurality of device units with a same pattern formed on a surface of the

substrate and each device unit includes a plurality of pixels **(Noguchi Figs. 27a and b – Col. 37 lines 36 – 48)**; a light source for irradiating a light on the substrate **(Noguchi Fig. 3 element 101)**; an image detector for sensing light reflected by a surface of the substrate from the light source **(Noguchi Fig. 3 element 205)**, wherein the image detector generates analog image data for each pixel of each device unit; an analog-to-digital converter for converting the analog image data to digital image data **(Noguchi Fig. 4 element 401 - Col. 14 lines 63 – 67)**; a data processing unit for forming first differential image data of a target pixel by subtracting the digital image data of a corresponding pixel from the digital image data of the target pixel **(Noguchi Col. 38 lines 45 – 46)**, the target pixel being a subject pixel for detecting a defect, and the corresponding pixel being a neighboring pixel that is positioned in a first device unit adjacent to a second device unit including the target pixel and that corresponds to the target pixel **(Noguchi Col. 37 lines 36 – 44)**; a reference setting unit for setting a threshold value **(Noguchi Col. 38 lines 53 – 55) [Note that although the threshold values are calculated, they are calculated prior to the actual comparison with data acquired in advance of similar LSIs (Noguchi Col. 41 lines 28 – 43)]** and a reference size range **(Noguchi Col. 45 lines 6 – 11)**, the threshold value being compared with the first differential image data **(Noguchi Col. 38 lines 47 – 52)** and the reference size range being compared with a defect size corresponding to a specific defect **(Noguchi Col. 45 lines 17 – 21)**; and a checking unit for checking a defective pixel, whereby the first differential

image data becomes second differential image data of the target pixel if the first differential image data is greater than the threshold value **(Noguchi Col. 40 lines 46 – 51)**, and the second differential image data of the target pixel becomes third differential image data of the target pixel, if the second differential image data of the target pixel is within the reference size range **(Noguchi Col. 46 lines 51 – 67; See Fig. 45)**, the checking unit checking the target pixel corresponding to the third differential image data as the defective pixel **[Note that in Fig. 45, only data of defects in the specified size range for each threshold-value map/image will be displayed]**.

b. Regarding claims 16, 22 and 24, Noguchi further teaches that the substrate includes a wafer for fabricating a semiconductor device and the device unit further comprises a unit cell operating as an independent electronic circuit on the wafer **(Noguchi Col. 13 lines 40 – 43 and Col. 41 lines 14 – 16)**.

c. Regarding claims 17, 18, 25 and 26, Noguchi further teaches that the irradiating light includes a short-wave light and specifically ultraviolet light **(Noguchi Col. 34 lines 26 – 27)**.

d. Regarding claim 19, Noguchi further teaches that the image data includes binary digital data **(Noguchi Col. 26 line 61 – Col. 27 line 4)**.

e. Regarding claims 21 and 28, Noguchi further teaches displaying the defective pixel and a defect image on a monitor **(Noguchi Col. 40 lines 51 – 57)**.

Claim Rejections - 35 USC § 103

6. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

7. Claims 1 – 14, 29 – 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Noguchi et al. (U.S. Patent No. 7,037,735) in view of Hung et al. (U.S. Patent No. 7,162,071). Hereinafter referred to as Noguchi and Hung respectively.

a. Regarding claims 1 and 29, Noguchi teaches a method and apparatus for detecting a defect on a substrate, the apparatus comprising: a support for supporting a substrate **(Noguchi Fig. 3 element 304)**, wherein the substrate has a plurality of device units with a same pattern formed on a surface of the substrate and each device unit includes a plurality of pixels **(Noguchi Figs. 27a and b – Col. 37 lines 36 – 48)**; a light source for irradiating a light on the substrate **(Noguchi Fig. 3 element 101)**; an image detector for sensing light reflected by a surface of the substrate from the light source **(Noguchi Fig. 3 element 205)**. Noguchi further teaches a reference-setting unit for setting a threshold value **(Noguchi Col. 38 lines 53 – 55)**, and comparison units to determine defective pixels based on the thresholds **(Noguchi Col. 38 lines 47 – 52)**. However, **Noguchi fails to teach** that the threshold value is digital image data of a specific defect, and a marking unit for marking a pixel as defective when the digital image data of the pixel is substantially identical to the threshold value. **Pertaining to the same field of endeavor, Hung teaches a self-learning defect classification system. Specifically, Hung teaches extracting**

image of a wafer (Hung Col. 2 lines 65 to 67), matching its contents with a dynamic library of previously obtained defect images to find defects (Hung Col. 8 lines 34 – 67) and classifying the defect based on its resemblance to the reference defect images. Hung teaches that prior to the classification processing, a defect image map is required which may be acquired by known methods. Furthermore, Hung teaches that such a defect automatic detection/classification system reduces an operator's loading time and accelerates the timing of the classification (Hung Col. 3 lines 61 – 63). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Noguchi's pixel-to-pixel comparison resulting in a threshold-value image map as input to Hung's classification system so as to compare the detected defects with a collection of known defect images, as taught by Hung, in order to not only detect defects, but also speedily classify them to determine the most appropriate corrective action.

b. Regarding claims 2 and 14, Noguchi further teaches that the substrate includes a wafer for fabricating a semiconductor device and the device unit further comprises a unit cell operating as an independent electronic circuit on the wafer **(Noguchi Col. 13 lines 40 – 43 and Col. 41 lines 14 – 16)**.

c. Regarding claims, 3 and 4, Noguchi further teaches that the irradiating light includes a short-wave light and specifically ultraviolet light **(Noguchi Col. 34 lines 26 – 27)**.

d. Regarding claim 5, Noguchi further teaches that the image data includes binary digital data **(Noguchi Col. 26 line 61 – Col. 27 line 4)**.

e. Regarding claims 6, 7 and 30, Noguchi further teaches that the binary digital data represents a level on a gray scale **(Noguchi Col. 44 line 20 – 25)**. Noguchi doesn't explicitly state that the gray scale is distinguishable by a relative density of black and white. However, **official notice is taken** that it is old and extremely well known in the art that grayscale images are composed of shades of gray, varying from black to white and are commonly represented in 256 quantized steps or levels when using common 8-bit processors and memory components.

f. Regarding claim 8, Noguchi, as modified by Hung with regards to claim 1 above, also teach that forming second image data of a specific defect comprises observing the substrate surface **(Hung Col. 2 lines 33 – 37)**.

g. Regarding claims 9 and 10, Noguchi further teaches observing the substrate surface comprises using an optical or electromagnetic instrument including a scanning electron microscope (SEM) **(Noguchi Col. 55 lines 15 – 19)**.

h. Regarding claims 11 and 12, Noguchi teaches that an upper (positive) and lower (negative) threshold are required to compare the pixel differences between the first and second images **(Noguchi Col. 38 lines 45 – 52)**. Although, Noguchi does not explicitly state that the second image data includes a range defined by upper and lower limits; it would be clear to one of ordinary skill in the art that

requiring a positive and negative threshold, indicates an expectation of—at least—an inspected image with a range of (grayscale) values. Additionally, as modified by Hung, the reference defect images are obtained by the same means as the inspected image **(Hung Col. 2 lines 33 – 37)**. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the reference defect (second) image would include a range of binary digital grayscale values.

i. Regarding claims 13 and 31, Noguchi further teaches displaying the defective pixel and a defect image on a monitor **(Noguchi Col. 40 lines 51 – 57)**.

j. Regarding claim 32, Noguchi further teaches that the image detector generates analog image data for each pixel of each device unit, further comprising an analog-to-digital converter for converting the analog image data to digital image data **(Noguchi Fig. 4 element 401 - Col. 14 lines 63 – 67)**.

8. Claims 20 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Noguchi et al. (U.S. Patent No. 7,037,735).

a. Regarding claims 20 and 27, Noguchi teaches all the limitations of dependent claim 19 and independent claim 23, respectively, as set forth in the 102 rejection of claims 19 and 23 above. Noguchi further teaches that the binary digital data represents a level on a gray scale **(Noguchi Col. 44 line 20 – 25)**. Noguchi doesn't explicitly state that the gray scale is distinguishable by a relative density of black and white. However, **official notice is taken** that it is old and

extremely well known in the art that grayscale images are composed of shades of gray, varying from black to white.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Taniguchi et al. (U.S. Patent No. 5,173,719) teaches a semiconductor wafer inspection system in which a difference image is obtained by comparing adjacent cells, the difference is compared to a black/white threshold, sections exceeding the threshold are labeled as possible defects, finally these candidates are saved as defects only if they exceed a set size value.

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL A. NEWMAN whose telephone number is (571)270-3016. The examiner can normally be reached on Mon - Thurs from 9:30am to 6:30pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir A. Ahmed can be reached on (571) 272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

M.A.N.

/Samir A. Ahmed/

Supervisory Patent Examiner, Art Unit 2624